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TOPIC: INVESIGATION INTO THE DESIGN ERRORS AND ITS IMPACT ON INITIAL COST OF CONSTRUCTION PROJECT

CASE STUDY: KANOMBE SECTOR IN KICUKIRO DISTRICT

A dissertation submitted in partial fulfilment of the requirements for the Award of advanced diploma In construction technology.

Presented by:

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Kigali, September 2024

DECLARATION OF ORIGINALITY

I do hereby declare that the work presented in this dissertation is my own contribution to the best of my knowledge. The same work has never been submitted to any other University or Institution. I, therefore declare that this work is my own for the partial fulfillment of the award of advanced diploma in construction technology at ULK Polytechnic Institute.

The name of candidate: UWAJENEZA Noella……

Signature of the candidate: …….

Date of submission: ……

APPROVAL

This is to certify this dissertation work entitled "**ASSESSING THE IMPACT OF URBAN EXPANSION ON AGRICULTURE LAND IN RWANDA. CASE STUDY: RUBAVU DISTRICT (2014 -2024)**" is an original student conducted by UWAJENEZA Noella under my supervision and guidance.

Supervisor's name **Eng. MUTIJIMA Jeannine** ……

Signature of the supervisor …….……

Submission date…….……

DEDICATION

I dedicate this dissertation work to:

My parents

My brothers and sisters

:

ACKNOWLEDGMENT

This Thesis has benefited greatly from substantial inputs, guidance and comments from many people and institutions.

First of all, I would like to thank to the Almighty God for giving the wisdom and granting me resources whether financial and non-financial that has made a great contribution to this research project and my education in general.

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ABSTRACT

The main objective of this study was to investigate how design errors can affect the initial cost of construction project. The specific objectives were to identify the causes of design errors in construction Project, to examine the impacts of design errors in construction Project and to examine the impacts of design errors on initial cost of construction Project. The questionnaire survey conducted in the 100 respondents from the active construction companies in Kanombe sector. Collected data were analyzed by tables and ranked using SPSS software. Based on the findings, it is concluded that the causes of design errors in construction project were the Speedy construction, Lack of detailed drawings, Engaging unqualified designers, Increase complexity in project, Poor supervision/coordination, Poor workmanship, Lack of systemic knowledge, Errors in calculations and the use of newly introduced materials, Unclear overview of the designs, Lack of coordination process, and Human mistakes, Insufficient fund to create quality documents, Insufficient time to create review quality documents, Low budgets for design, Project managers not understanding the scope of the project, Miss-coordination between lead designer and consultants, Confusion created by owner decisions or indecision's, and in turn, client not coordinating as to what is required, Designer rushes out drawings before proper review, Budget and time pressure on the designer, Lack of construction knowledge and experience of designers, Inadequate training, Engaging unqualified designers, Lack of knowledge about material performance, Unrealistic scheduling of design task functions and the use of time boxing, Underestimating the resources required for designing tasks, Poor bid or no bid responses. Based on the impacts of design errors in construction Project, The findings show that the impacts of design errors in construction Project were construction project cost overruns, Schedule delays, Unsafe environments which affect project performance, Failures occurring in civil engineering projects, Cause pressure on the schedule and also affect the quality of the work, Design error makes the amount spent on rework at design face to be more than the one at construction stage and design errors influence the quality of design. The findings shown that the impacts of design errors on initial cost of construction Project were Design errors contributes to accident on site, the cost of rectifying errors and omission increases a project cost, design errors contributes to project failures accidents and loss of life, design error result in time and cost overrun and design errors can adversely influence project performance

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LIST OF ACRONYMS AND ABBREVIATIONS

RHA **:** Rwanda Housing Authority

HR : Human Resource

HRM : Human Resource Management

ULK : Kigali Independent University

UPI : ULK Polytechnic Institute

HoD **:** Head of Department

CHAPTER ONE: GENERAL INTRODUCTION

1.0. Introduction to the study

This chapter highlights the background of the study, problem statement, purpose of the study, objective of the study, research questions/ hypothesis, scope of the study, significance of the study and organisation of the research.

1.1. Background of the study

An error is defined, according to Webster, as "a deviation from accuracy or correctness; a mistake, as in action or procedure; an inaccuracy, as in speaking or writing." There are basically three types of errors: imperfections, non-conformance and omissions. Imperfections are deviations in details that have no affect on the assembly or facility (Baiburin, 2017). From the evaluation above a simple definition of design error is "a deviation from the plans and specifications." It is not the intention of this definition to include any final cost or schedule growth or insinuate its root causes or legal responsibility. It is the responsibility of the owner, designer and contractor to establish the criteria in order to make a reasonable determination for responsibility. The survey shows a common theme, that of a mistake or error in the design. Building design refers to the broadly based architectural, engineering and technical applications to the design of buildings. Many factors enter into the design of buildings, including cost, purpose, occupancy, and location (Shamsudeen & N, 2016).

Design is an important step in construction project. Errors in design cause failure in construction stage as well as the project development. Misunderstandings of design concept between parties lead to design errors that able to decrease the quality of construction works, and also cause cost overruns and project delays. Design errors also contribute to engineering failures, which can result in accidents and loss of life. Preventive actions in reducing the errors are necessary. In accordance with these issues, this research is conducted with main purpose to identify the causal factors of design error. Review to previous studies with main topic of design error was taken in order to identify the causal factors (Ola-Ade et al., 2021).

When asked to define “design error,” not all disciplines in the construction process agree on a common definition. Depending on which discipline you address, the owner, the designer or the contractor there will be a common understanding surrounded by varied conclusions, “a mistake.” From the basic definitions of “design” and “error”, we conclude that a design error is a deviation from a drawing or specification, also including omissions and ambiguities. It is the seriousness of this error that must be considered to determine its consequences on the overall outcome of the project. Design errors can adversely influence project performance and can contribute to failures, accidents, and loss of life (Peansupap & Ly, 2015).

Rwanda has registered an annual population growth rate of 2.3% over the last 10 years, reaching 13,246,394 in August 2022 and is projected to be 23.6 million by 2052. The construction sector in Rwanda is experiencing a huge boost due to the population growth rate of 2.3% annually. The growing demand in the construction and real estate sectors is being experienced by Rwanda on a massive scale. Every year, 28 thousand and 35 thousand housing and commercial units are in demand within Kigali; struggling to meet this need are the developers. "Taking a significant chunk of the GDP the construction sector has really boomed in various sectors, infrastructure, offices and developments (Maina & Jagongo, 2022). Demand for Construction of buildings is increasing at rapid rate; in City of Kigali alone the demand for Housing is between 8,500 – 10,000 units per annum; the combined demand for housing in the rest of the urban centres of Rwanda is estimated to be about 15,000 units per annum (Dosumu et al., 2023).

The construction sector has had phenomenal growth in Rwanda. It has been responsible for the continued growth in GDP over the past 10 years. There is no sector of the Rwandan economy that shows more promise than the construction sector and associated industries. The Rwandan construction industry remains largely dominated by the traditional procurement method which is characterized by enormous errors in construction documents. These errors have led to the exasperation of several clients, building collapses, disputes, reduction of profit for contractors, reputation for consultants, loss of confidence and discouragement of investment in the construction industry. Building collapse has had debilitating effects on the lives, properties and investments of the Rwandan populace and many of them are linked to errors in the design or construction of the projects (Ola-Ade et al., 2021).

Construction and engineering practitioners have found it increasingly difficult to learn from their mistakes, particularly with regard to the prevention, identification and/or containment of design errors. John. et al, (2001) explained that majority of structural failures and associated damage costs are due to errors in planning, design, construction, and utilization, rather than variability in construction material, strengths and structural loads. It should be recall that design is the first stage of construction and design errors have been the root cause of numerous catastrophic accidents that have resulted in the death and injury of workers and members of the public. Design errors indicate the total design effectiveness of a project, major design quality problems occur during construction when errors, omissions and ambiguities in plans and specifications become evident. A large amount of country's maintenance resources is being expended on corrective or remedial measures to buildings and their services due to design or construction defects (Dosumu et al., 2023).

The construction industry has generally been tagged with poor project performance. Cost and time overruns are the leading causes of poor performance. The construction industry is an important aspect of every national economy which contributes to the national Gross Domestic Product (GDP), employment, and environmental development of the countries. However, it has been continually plagued by poor project performance in terms of cost, time, quality, safety and sustainability criteria. Poor project performance is peculiar to many countries especially the developing ones like Rwanda. Studies (Ola-Ade et al., 2021) indicated that many factors influence the cost and time performance of construction projects in the form of cost and time overrun. Many of the factors attributed to poor cost and time performances were traced to errors in construction documents.

One of the most important challenges facing management today is controlling the all too frequent cost and schedule overruns that effect the Rwandan construction industry. One of the major issues to control growth in project costs and time is the reduction of design errors. The owner, designer and contractor all have different interests in, or uses for the design of a facility (Peansupap & Ly, 2015). But what they do share is the commitment to complete the project safely and within a given budget and completion time. There are many initiatives being conducted to control the growth of the cost and schedule within the construction industry. The

major issue is “accuracy of the drawing” or the number of the design, omissions and ambiguities within the plans and specifications that affect the quality. Inadequacies in the plans and specifications are the major causes of changes to the contract. So much emphasis is placed on the issue of time and cost that quality takes a back seat (Baiburin, 2017)

The quality of the project depends on the conformance of the objectives and requirements from the owner. An informative quality management technique will provide an agreement to procedures and definitions among the principle parties for the project. Since design, errors have an impact on the outcome of the effectiveness of the contractor’s effort on the project it is essential that all parties determine what the definition of a design error should be. When asked to define design error, not all disciplines in the construction process agree on a common definition. From the basic definition of design and error, it can be determined that a design error is a deviation from a drawing or specification. It is the seriousness of this error that must be considered to determine its consequences on the overall outcome of the project (Ola-Ade et al., 2021).

1.2.Problem statement

Design errors indicate the total design in-effectiveness of a project. Major design quality problems occur during construction when errors, omissions and ambiguities in plans and specifications become evident. This statement directs that the inadequacies in the plans and specifications are the major causes of changes to the contract. Studies (Lopez & Love, 2012)indicated that many factors influence the cost and time performance of construction projects in the form of cost and time overrun. Many of the factors attributed to poor cost and time performances were traced to errors in design or construction documents. Design errors have led to the exasperation of several clients (Love et al., 2011), building collapses, disputes, reduction of profit for contractors, reputation for consultants, loss of confidence and discouragement of investment in the construction industry. Building collapse has had debilitating effects on the lives, properties and investments of the Rwandan populace and many of them are linked to errors in the design or construction of the projects.

There have been extreme examples of design errors such as numerous building collapse in Kigali construction projects that have wrought disaster after the construction are completed. These are examples of design errors that escaped the close scrutiny of all parties. One or two major errors that can be corrected with only cost considerations and little effect on the schedule can affect projects. The projects that really suffer are those with many small errors (design, rework or change of scope) which when finally added up cause major impacts on the cost and schedule growth (Lopez & Love, 2012).

Through Davis and Ledbetters research it was determined that "accuracy of the design documents" was the most critical of the criteria used in the initial evaluation of design effectiveness. This accuracy was further described as the concern for the frequency and impact of errors in the specifications and drawings (Ola-Ade et al., 2021). This is due to the fact that the drawings and specifications are the most "readily identifiable outputs of the design process." It is evermore important that the quality control of designs be addressed during the planning phase and closely monitored during the construction phase. Among the project performance criteria, cost and time performances appear to continually be the key measures of construction project success for all stakeholders. The construction industry in Rwanda has generally been tagged with poor project performance. Cost and time overruns are the leading causes of poor performance (Peansupap & Ly, 2015).

All what have been discussed above aroused the curiosity of the researcher to study the extent to which the design errors affected initial cost of construction project, focusing on Kicukiro district. The reasons pushed researcher to conduct this research want to know deeply the causes of design errors, impacts of design error and the impacts of design errors on initial cost of construction project.

1.3.Purpose of the study

The purpose of this study is to know deeply the causes of design errors, impacts of design error and the impacts of design errors on initial cost of construction project.

1.4. Objective of the Study

1.4.1. Main objective

The main aim of the study is to investigate how design errors can affect the initial cost of construction project.

1.4.2. Specific objectives

The specific objectives of this project are;

a) To identify the causes of design errors in construction Project.
b) To examine the impacts of design errors in construction Project.
c) To examine the impacts of design errors on initial cost of construction Project.

1.5.Scope of study

The project of providing the impacts of design errors on initial cost of construction project in Kicukiro district is the main point of interest. Due to time constraints, it was limited to some geotechnical work which will be used will be derived from secondary data if necessary and it will only carried out on the constructions project in Kicukiro district.

1.6. Significance of the study

The research will help the people in terms of personal, academic and social interest. This section deals with motives which pushed the researchers to choose and be interested in her/his topic. The study will be important to the researcher, to ULK Polytechnic Institute and to the Rwandan society in general also Government, and to the other researchers.

1.7.1. Personal significance

The study will help me as researcher to acquire knowledge and experience on the impacts of design errors on initial cost of construction project and it will also help me to fulfill part of academic requirements for acquisition of advanced diploma (A1) in construction technology.

1.7.2. Academic significance

The research will provide a research report available to the library of ULK Polytechnic Institute and also this research will act as references to other future researchers who wish to carryout similar research in their studies.

1.7.3. Social significance

This study gives a clear insight into the various ways in which contractors in the construction companies in Rwanda can maximize profits and reduce initial cost through effective and efficient contract planning and management. The study also gives a clear insight into the various effects of design errors on the initial cost of construction project. The findings and recommendations of the researcher will help in building a strong and better project management guideline for contractors in Rwanda.

Also, the study of the investigation of the effect of design errors on the initial cost of a construction project will provide results that will offer the following benefits: establish the scope and methodology of design functions performed by architectural firms for the benefit of the entire construction industry including prospective building clients, assist designers in understanding the cost implication of design errors, so that they can make objective design decisions during the early phase of a project, avail the designer with a tool for eradicating errors that are directly related to the designer that delay and or add cost to the project.

1.7. Structure of the research

This work consists of five chapters, where chapter one will be the general introduction, which comprises the introduction of the study, background of the study, problem statement, purpose of the study, the objectives of the study, research questions, scope of the study, significance of the study and the organisation of the study. The second chapter will be the literature review, which will be about the general understanding of the reviews of other researchers with the related studies. The third chapter will be the research methodology and it will focus on the methods and materials to be used to achieve the objectives of the study. The fourth chapter will be the results and discussions and it will be the most important one because it will show the presentation of the

results acquired. The fifth one, which will be the last chapter, will cover the conclusion and recommendations with respect to the predefined objectives.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

This chapter provides an overview of different authors in respect to the topic. It clarifies the definitions of key concepts relate your topic, theoretical framework related to the study, review on design errors and its effect on the initial cost of construction project, review of past studies or empirical review, critical review and finally the summary of the study so that the future readers may have the clear idea of terms with which the topic is made up. In addition, this chapter presents the overview and the general outlook concerning how.

2.2. Definition of the key concept

In fact, the study defines the key concepts to make literature clearer and more understandable.

2.2.1. Design

Design is an important step in construction project. Errors in design cause failure in construction stage as well as the project development (Design et al., 2002).

2.2.2. Error

An error is defined, according to Webster, as "a deviation from accuracy or correctness; a mistake, as in action or procedure; an inaccuracy, as in speaking or writing." There are basically three types of errors: imperfections, non-conformance and omissions (Ola-Ade et al., 2021).

2.2.3. Design error

Design Error means any non-compliance with this Agreement or applicable Laws; or any: error or omission in; or Discrepancy, incompleteness, lack of integration, lack of co-ordination or lack of detail within or between, any one or more of the Deliverables. Design error, also known as latent human error, is a mistake that is waiting to happen because of a poor design (Ola-Ade et al., 2021).

Musa et' al (2016) stated that a large amount of country's maintenance resources is being expended on corrective or remedial measures to buildings and their services due to design or construction defects. Reichart (2006) attested that design errors are unavoidable failures occurring when information is erroneously applied or used or when the pertinent information is not accessible. It is also as a result of failure on the human part to design task within time limit accuracy, deviations from actual values, inadequate precision and inconsistency in measurement. Design errors refer to imperfection/flaws design omission and design conflicts (Coutio, 2012).

These types of errors are often associated with lapses and slips due human negligence, carelessness usually performed during unconsciously routine activities determined by mentally

programmed instructions from previously stored thought pattern (Heneman and Gawlinski 2004), ‘lapses’ as used simply meant or regarded as memory and out of discrepancies/failure totally usually between the work intent and it actual performance (Henriksen and Dayton 2006) In spite of individual ability and attentive lapses are vastly prevalent and ubiquitous part of life (Cheyne & Smilek 2006).

Lapses owned also imply absent mindedness which are rampant in individual daily occurrences (Carrier 2008). The ‘slips’ on the other hand as applied in construction perspective is a term most used interchangeably with ‘lapses’ in skilled/performance-based error as designed as Al Hattab, and Hamzeh, (2013). These are errors in the action process of a single individual and are likely to be diverged from the team activities as a whole. ‘Slips’ primarily emerged from the executing process of a task action cycle.

2.2.4. Initial cost

Initial Costs refer to the one-time expenses incurred when starting any type of business. Initial Costs include any one-time cost that is required to get the system in question operational. Most often, this is a combination of Material and Installation costs. Recurring Costs include any cost that accrues over time (Joshua et al., 2019).

2.2.5. Construction project

A project is a series of related a tasks which when they are carried out in the correct order will lead to the completion of the project. Projects are temporary, generally resulting in the creation of a tangible product or outcome. This is as opposed to a programme, which is a series of interrelated projects that may be carried out repeatedly or continuously in order to support an ongoing process. A construction project, sometimes just referred to as a project, is the organised process of constructing, renovating, refurbishing, retrofitting or adapting a building, or other built asset such as tunnel or bridge (Bilau et al., 2015).

A construction project, sometimes just referred to as a 'project', is the organised process of constructing, renovating, refurbishing, retrofitting or adapting a building, or other built asset such as a tunnel or bridge. Construction projects are typically one offs (particularly in the UK).

That is, a project team, brief and financing are put together to produce a unique design that delivers a single project. Once the project is complete the team is disbanded and sometimes will not work together again. This can make it difficult to develop ideas or relationships, and so lessons learned are often not carried forward to the next project. The exceptions to this are repeat developers such as supermarket chains, house builders, and so on (Lopez & Love, 2012).

2.3. Design errors in building construction projects

Design errors are inevitable in the construction industry. Many researchers consider design errors as the most critical problems and have defined the term ‘design errors’ in various ways. (IRC:86-2018, 2018) claims that design errors are unavoidable failures occurring when information is incorrectly applied or used, or the pertinent information is not accessible. ’Design errors’ refers to the failures of humans to design tasks within time limits and accuracy. Owing to the required level of accuracy and time constraints, common human errors can lead to design errors. These problems can influence the quality of both design and construction. Deviation from actual values, inadequate precision and inconsistencies in measurement are also considered as design errors. In this article, ‘design errors’ refers to design mistakes, design omissions, and design conflicts (Shamsudeen & N, 2016).

Design mistakes are the human errors that are occur naturally and are unavoidable. An inexperienced designer may apply the design information incorrectly. These mistakes can be lapses (memory failures) or slips (when failure arises even if knowledge is correct). Design omission occurs if any part of a system has been forgotten in the design. Design conflicts are the overlapping items that cannot be constructed at the same time (Ola-Ade et al., 2021).

2.4. Factors that causes Design Errors

Ten out of the identified factors that causes design errors were ill-defined or unclear scope of work, speed of work, Use of narrow stairs, passages and doors, Inadequate provision for movement, attempt to produce maximum profit by minimizing staff, Owner changing design criteria late in the design process, Project managers not understanding the scope, Miss-coordination between lead designer and consultants; and confusion created by owner decisions or indecision's, and in turn, Client not coordinating as to what is required, Budget and time pressure

on the designer human error were seen not to be significant to the factors that causes of design errors in construction projects (Lopez & Love, 2012).

Below are the general cause of design errors; insufficient fund to create quality documents, insufficient time to create review quality documents, lack of coordination between principle players and others discipline, ill-defined or unclear scope of work, human error, speed of work, use of narrow stairs, passages and doors, inadequate provision for movement, attempt to produce maximum profit by minimizing staff , government spends too much time reviewing the A &E's work, owner changing design criteria late in the design process (Ola-Ade et al., 2021)

Low budgets for design, project managers not understanding the scope of the project, miss-coordination between lead designer and consultants; and confusion created by owner decisions or indecision's, and in turn, client not coordinating as to what is required, designer rushes out drawings before proper review, budget and time pressure on the designer and designers lack of construction knowledge and experience, inadequate training, engaging unqualified designers, lack of knowledge about material performance, unrealistic scheduling of design task functions and the use of time boxing, underestimating the resources required for designing tasks (Peansupap & Ly, 2015).

2.5. Groups of design errors between structural and other building components

Detailed building design process consists of five disciplines: architectural design, civil design, structural design, mechanical design, and electrical design. Mechanical, electrical, and plumbing systems (MEP systems) have caused many problems related to limited space for MEP system installation. This suggests that it is necessary to study about design errors associated with MEP systems. Design errors in structural and plumbing works are also included in this study, while civil work is excluded because it is not about the internal structure of the building (Erol & Unal, 2015).

According to the detailed building design process and the necessity of MEP systems, design errors between structural and other building components involve five different groups, such as design errors between structure and architecture (Group A), design errors between structure and

structure (Group B), design errors between structure and mechanical works (Group C), design errors between structure and electrical works (Group D), and design errors between structure and plumbing systems (Group E) (Gutti, 2018)

2.6. Types of design and construction errors

Eleven major groups of faults were identified as the major errors in design and construction projects; they are, the defects in civil design, architectural defects in design, design defects in maintenance practicality and adequacy, defects due to consultant firm administration and staff, defects due to construction drawings, defects due to construction inspections, defects due to civil construction, defects due to contractor administration, defects due to construction equipment, defects due to construction materials and defects due to specifications (Ola-Ade et al., 2021).

The other types of construction error are narrow stairs, passages and doors, specifying finishing which need to be repaired as a whole, inadequate joints between finished face, not considering the local climate condition when designing exterior shape, not relating exterior material selection to climate condition. Inadequate provisions for movement, ignoring aggressive environment and weather condition effects, ignoring biological effects, inadequate such structural design foundation. ignoring variation in soil conditions, ignoring load impact on structured stability, exceeding allowable deflection, ignoring wind effects on the structure, inadequate concrete cover on the reinforcement, improperly locating conduits and pipe openings at critical structural locations, poor technical updating or staff training, hiring unqualified designers, lack of designer field experience, lack of designer technical background, Designer ignorance of materials properties, misjudgment of climatic conditions, misjudgment of user's intended use., Lack of references, Conflicting details, Lack of details (Baiburin & Baiburin, 2019),

2.7. Impact of design errors on initial cost of construction project

Design errors are unavoidable in any construction projects and can negatively affect cost, schedule and safety performance. The different types of design drawings may have various levels of design errors due to many factors such as unclear overview of the designs, lack of coordination process, and human mistakes. Civil engineers, both designers and contractors, have limited understanding of the importance of design errors that occur in construction phases.

Design errors are an inevitable and important issue which have negative impact on project management efficiency and effectiveness. They are the important contributors to reworks, cost overruns, schedule delays, and unsafe environments which affect project performance (Dolacek-Alduk et al., 2020)

In practice, owner, designer, contractor, and other stakeholders have different interests in the design. These various interests certainly lead to design errors which can arise at any time. The occurrence of these errors can increase many difficulties in construction management. These difficulties can lead to between 80% and 90% of the failures occurring in civil engineering projects. They can also incur more cost that adds a project's value around 14.2%. Design errors are a serious threat to construction projects. Besides, the use of technology is limited in construction development in Cambodia because of inadequate human resources and limited education system (Shamsudeen & N, 2016).

This is a reason that the occurrence of design errors cannot be effectively controlled and can greatly affect the construction process. Design errors are thus very significant and should be carefully managed to ensure the success of construction projects and to minimize difficulties in project performance. To create an effective strategy to manage design errors, it is important to recognize the level of their impact. The impact of design errors has been already assessed in previous studies; however, only schedule delays have been studied by developing a model of seven sub-modules, such as generic work execution, effort, precedence relationship, productivity, resources, progress measurement, and managerial control (Jraisat, 2020).

There are many initiatives being conducted to control the growth of cost and schedule within the construction industry. The major issue is the "accuracy of the drawings," or the number of design errors, omissions and ambiguities within the plans and specifications that affect the quality of the facility. So much emphasis is placed on the issue of time and cost that quality takes a back seat. The quality of the project depends on the conformance of the objectives and requirements. This is achieved if the owner establishes and communicates the scope of work to the designer who then clearly stated these requirements in the contract documents (Eze, 2020).

An informative quality management technique will provide an agreement to procedures and definitions among the principle parties for the project. It is understood that the more time established in the design and bidding phase will lead to a quality product that will finish within schedule and within budget. This will minimize litigation and confrontation. The design team should continually educate themselves with the construction techniques performed by the contractor and incorporate that knowledge into the details of the project by integrating quality as the main focus of the design, the design team will be required to deal with communication between the principle parties, coordination of the other disciplines and adequately review the plans and specifications before issue (Jacob et al., 2022).

The survey produced several feasible recommendations, to improve the quality of design and reduce the design errors to include omissions and ambiguities. First and foremost is resolving the scope definition before starting the project construction. It should be a joint effort between the understanding of managerial skills and what constitutes a design error that will affect the cost owners, designer the contractor in the major concepts. Before any contractual agreement, there should be an open line of communication between all the principle parties. Included in that is the and schedule of the project. The greatest measure of success is the sharing of information (Juremalani, 2021).

Designers should take full control of the review process, both in-house and out-of-house. Adequate time should be given to complete the design documents including reviews, field investigations and greater involvement in the inspection process. Provide the designer and contractor an avenue to discuss problems and resolve them without intervention of the owner. The cost of doing business is growing every year and the percentage for payment has remained the same. Computer Aided Design (CAD) has not decreased the expenditures but raised them. In promoting the design factor of quality over time and cost all parties will create a win-win scenario and ensure the highest quality of construction (Informa- & Efficiency, 2023).

CHAPTER THREE:RESEARCH METHODOLOGY

3.1. Introduction

This chapter will describe the procedures that will be followed in conducting the study. The techniques of obtaining data will be also explained. The study area, population, sampling techniques, sample size, data collection instruments, data collection procedures and data analysis methods will be discussed in details.

3.2. Description of the study area.

Kanombe sector is one of 10 administrative sectors that make up the Kicukiro District. Kanombe sector has 4 cells (Kabeza, Karama, Rubirizi, and Busanza). Kanombe Sector has 72,346 Population [2022] – Census with 3,146 /km² Population Density [2022] and it has 23.00 km² Area.

3.3. Location of study area.

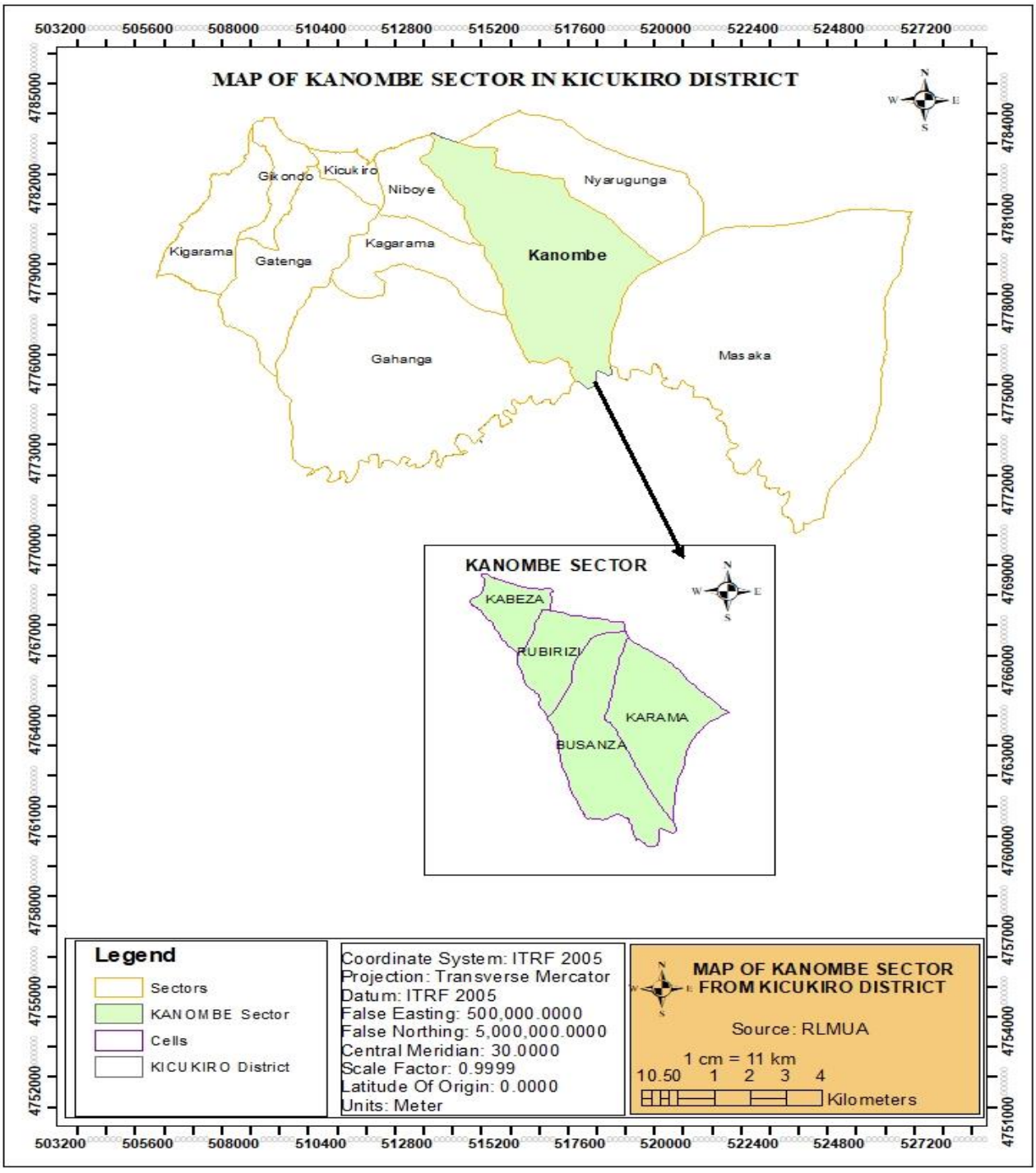

Figure 3 1**: Map of the study area**

3.4. Research design

A research design is a broad plan that states objectives of research project and provides the guidelines to realize those objectives. It is a plan of how a research project is conducted (Berg, 2009). This study will use descriptive research design, descriptive research design is a method of collecting data by interviewing or administering a questionnaire to a sample of individuals, it helps to depict the respondents correctly and it also enhances detailed description of the problem under the study (Creswell & Plano-Clark, 2007).

The purpose of this method is to describe "what exists" with respect to situational variables i.e. it looks at relationship between independent and dependent variables. However, the study used quantitative research to gain better knowledge and understanding of the results. The quantitative research approach makes use of statistics and numbers which are mostly presented in figures. Hence, quantitative design is appropriate for this study as it enabled the researcher to quantify the impacts of construction materials management projects on the project in Kanombe sector / Kicukiro district.

3.5. Study population

The study population is a set of people, services, elements and events, group of things or households that are being investigated or that a research is concerned (Morrison, 2010). The population size for this study was 100 people composed by 20 Architects and 35 Quantity surveyors, 10 Project managers, 10 Foremen, 10 Project Engineers and 10 Land surveyors, 1 Engineer at sector level, 3 Engineers at district level and 1 Engineer at Rwanda Housing Authority.

3.6. Sampling techniques and sample size

This section highlights sampling techniques used to pick the sample from a larger population and simple size used in this study

3.6.1. Sampling technique

Sampling techniques provides a range of methods that help to reduce the amount of data to be collected by considering only data from subgroup rather than all possible case elements (Saunders, et al., 2016). Sampling technique is the methodology that is used to select the sample from a larger population (Berg, 2009). For the purpose of this study, respondents will be selected using purposive sampling technique. Purposive sampling, also known as judgmental, selective, or subjective sampling, is a form of non-probability sampling in which researchers rely on their own judgment when choosing members of the population to participate in their surveys.

In this research, purposive sampling was used because the researcher targeted only the 20 Architects and 35 Quantity surveyors, 10 Project managers, 10 Foremen, 10 Project Engineers and 10 Land surveyors, 1 Engineer at sector level, 3 Engineers at district level and 1 Engineer at Rwanda Housing Authority on the active construction sites in Kanombe sector.

3.6.2. Sample size

Sample size is a subset of the entire population identified. This comprises of certain members selected from the total population. A sample size is a small group of cases drawn from and used to represent the large group or whole population under investigation (Sekaran, 2005). The study will consider the architects and quantity surveyors on active construction sites and will be selected purposively where every people in population taken, has equal chance of being selected as respondent. The sample size of this study was composed by 100 respondents composed by 20 Architects and 35 Quantity surveyors, 10 Project managers, 10 Foremen, 10 Project Engineers and 10 Land surveyors, 1 Engineer at sector level, 3 Engineers at district level and 1 Engineer at Rwanda Housing Authority.

Table 3. 1**: Description of simple size**

Study population	Sample size	Data collection tool	Sampling technique
Architects	20	Questionnaire and	Purposive sampling

		interview	
Quantity surveyors	10	Questionnaire and interview	Purposive sampling
Project managers	10	Questionnaire and interview	Purposive sampling
Project managers	10	Questionnaire and interview	Purposive sampling
Foremen	10	Questionnaire and interview	Purposive sampling
Foremen	10	Questionnaire and interview	Purposive sampling
Project Engineers	10	Questionnaire and interview	Purposive sampling
Land surveyors	10	Questionnaire and interview	Purposive sampling
Engineer at sector level	1	Questionnaire and interview	Purposive sampling
Engineers at district level	3	Questionnaire and interview	Purposive sampling
Engineer at Rwanda Housing Authority	1	Questionnaire and interview	Purposive sampling
Total	**100**	**100**	

3.7. Source of data collection

This study used both primary and secondary data as sources of desired information for the study. Primary data were gathered by using questionnaire and interview and secondary data were gathered by using documentary review. These data were presented in the following section:

3.7.1. Primary data

Primary data comes straight from the people a researcher is researching from and is therefore the most direct kind of information a researcher can collect. The primary data is said to be the first hand observation and investigation (Cooper & Schindler, 2001). During the study, the researcher collected primary data through self-administered questionnaires and interview from people on the active construction sites.

3.7.2. Secondary data

Secondary source of data involves information gotten from already conducted research work that relates to the study (Morrison, 2010). Therefore, during this study the researchers will obtain secondary data from books; reports; journals and electronic-published, maps, Google map, Ortho-photos sources. A number of documents available in ULK Polytechnic Institute main library, in the active construction sites, on the internet, Kanombe sector reports; thesis and dissertations relating to the subject material will be consulted for the purpose of obtaining secondary information.

3.8. Data collection techniques

In collecting data of this study, questionnaires, interviews and documentation techniques will be used in order to get information from respondents. Computer via internet will help to collect some information related to literature review. Smart phone will be used to take pictures for further analysis during interpretation of data.

3.8.1. Questionnaires techniques

Questionnaire is a set of questions which are asked to get information from a respondent. It is a set of questions prepared by the researcher to be distributed to a particular sample (Orodho & Kombo, 2002). A questionnaire will be designed and pre-tested before the researcher submits it to the selected respondents. A questionnaire will be designed and pre-tested before the researchers submit it to the selected respondents. The questionnaires comprised both close-ended and open ended questions. The researchers will use information obtained via questionnaires in order to make an efficient analysis. In the present study, the researcher will submit the questionnaires to the architects, quantity surveyors, engineer at Kanombe sector level, engineers at district level and engineer at Rwanda Housing Authority in order to get the needed information.

3.8.2. Documentary review

The documentation is research tool which focuses on the systematic searching from any written documents which are relevant to the field of the research (Sekaran, 2005). With this method, various written documents containing information related to the topic under study will be reviewed. Among those documents include dissertations from ULK Polytechnic Institute main library, the active construction sites, Kanombe Sector and Rwanda Housing Authority reports, journals and other important documents relevant to the topic under research.

3.8.3. Interview technique

The interview can be defined as face-to-face conversation between an interviewer and the respondent, conducted for the purpose of obtaining information (Leedy & Omrod, 2015). The researcher made a set of questions known as interviews guide to be asked to the architects, quantity surveyors, engineer at Kanombe sector level, engineers at district level and engineer at Rwanda Housing Authority in order to collect information related to the study. The interviews will be conducted on site by site.

3.9. Data processing and analysis

Collected data were sorted, edited, coded and tabulated for analysis. During this process, the data collected will be transformed into meaningful information for easy interpretation and understanding. Hence, the data will be analyzed by arranging and organizing them properly so as to be easily interpreted. The following steps will be used in data processing and analysis.

3.9.1. Data processing

Data processing is generally the collection and manipulation of items of data in order to produce meaningful information (Bowling, Research methods in health: investigating health and health services. 2nd edition., 2002). This research project will process data through editing, coding and tabulation in order to gather quality information to be used in this research project.

3.9.1.1. Editing

Editing refers to the process where errors in complicated answers are identified and eliminated whenever possible (Robson, 2002). Editing will be used to check completeness, accuracy, uniformity and comprehensive of data collected. The major aim of editing will be to discover mistakes made during the field study, to monitor accuracy and find out whether there are some unfilled spaces in questionnaire guide.

3.9.1.2. Coding

Coding is a process of summarizing data by classifying different responses, which was made into categories for easy interpretation and analysis (Kakooza, 1996). The purpose of coding in surveys is to classify questions into meaningful categories so as to bring out their essential patterns. In coding the questions numbers were used. This will be used in this study to summarize data by classifying the different respondents into categories for easy treatment.

3.9.1.3. Tabulation

Tabulation is a simple process of counting the number of observations that are classified into certain categories (Kakooza, 1996). Tabulation consisted of putting the data into some kind of statistical tables such as percentages occurrence of the responses to particular question and their calculated percentages will be done by the researcher in order to present findings in a clear way.

3.9.2. Data analysis

The act of testing hypotheses stated in this research, the descriptive statistic will be used in order to find out the relationship between the impact of variables of the subject stated as independent variable and dependable variable. There is also an application of value judgments in the interpretation of a variety of responses or observations as qualitative measures in data analysis. Discussion and observations are complemented based on value given in the study as an addendum to analyzing quantitatively (Dickson, 2012). The Microsoft excel will be used to determine frequencies in order to discover the degree of occurrence to each variable. The study will be analyzed by using inferential statistics using Pearson correlation to determine relationship between variables. Tables were used to present findings.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.0. Introduction

This chapter presents the results obtained from questionnaires and explains the results obtained from the field work. It consists of the following: social demographic data of the respondents, causes of design errors in construction project, impacts of design errors in construction project and the impacts of design errors on initial cost of construction project.

4.1 Social demography of the respondents

This subsection presents the social demographic data of the respondents by age, sex, level of education and employment status, in fact that respondents have given precise information, SPSS version 25.0 was used for analysis and the results are displayed in tables, and bar graph.

4.1.1. Identification of surveyed respondents by Age

Figure 4.1 is a bar graph that depicts the age of the respondents. It was observed that; 40% respondents were at the range of 21 to 35 years of age, 30%respondents were at the range of 36 to 49 years of age, 25% respondents were at the range of 50 to 63 years of age and 5% respondents were at the range over 63 years old.

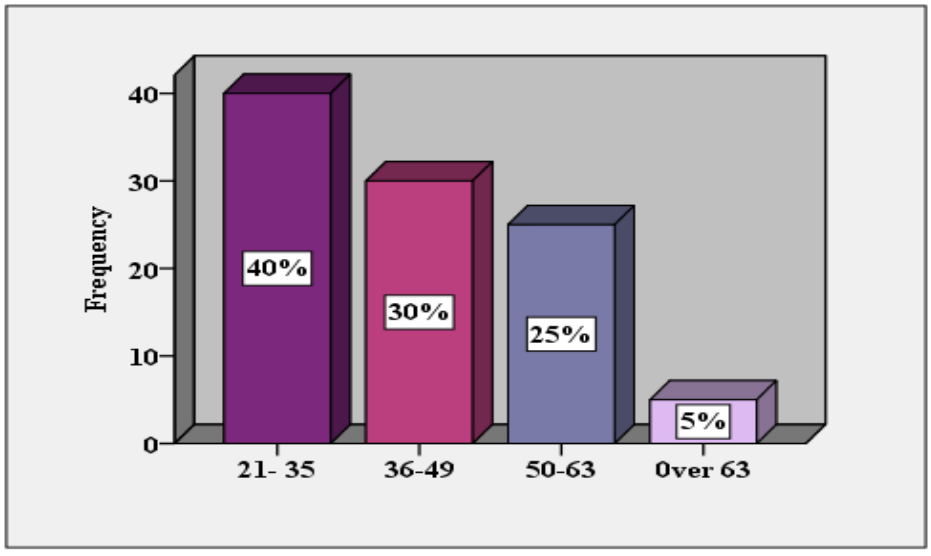

Figure 4 1: Age by respondents

4.1.2. Identification of surveyed respondents by gender

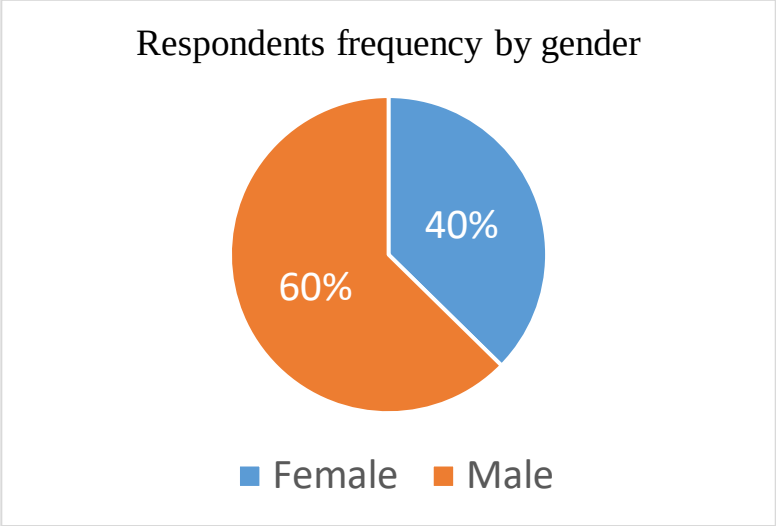

Figure 4. 2**: Respondents by gender**

Figure 4.2 presents the respondents by gender. The surveyed respondents under this study were given equal opportunity where both male and female participated actively in providing responses. There was enough freedom to the respondents in answering the research questions. 40% of respondents were female, while 60 % of respondents were male. The researcher surveyed the respondents according to their gender in order to make comparison between male and female participation in this survey. The results show that a large number were male with 60% of respondents, because the questions asked were not gender sensitive. The difference in number between man and women doesn't have any significance.

4.1.3. Identification of surveyed respondents by marital status

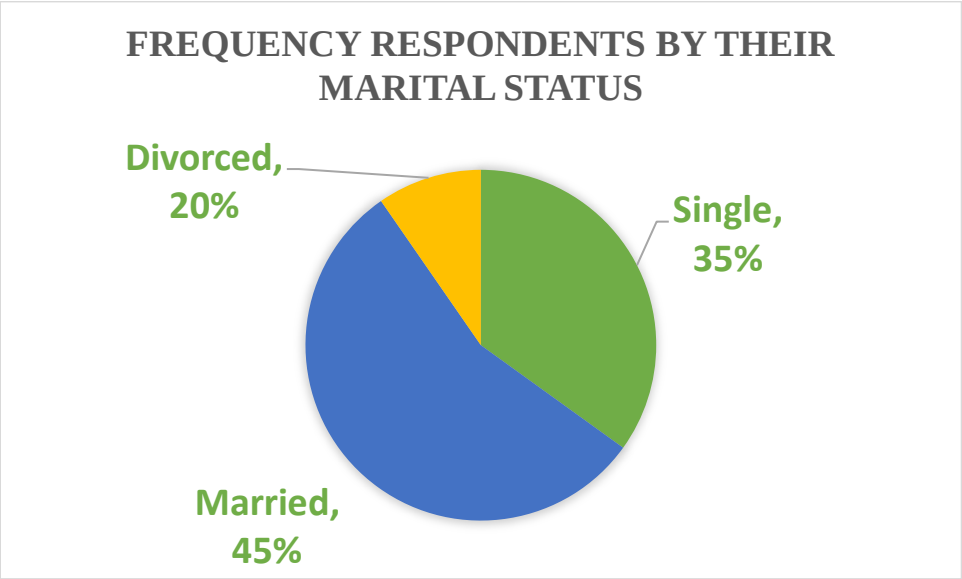

Figure 4 3**: Respondents by marital status**

In this study, 20% of respondents were divorced, and 45% of respondents were married, while 35% of respondents were still single. The researcher surveyed respondents in relation to their marital status in order to investigate the level land investment among different marital status. The results show that the married peoples invest in land at high level than single and divorced ones. This is because most of single people are interested in real estate investment for business or other reasons.

4.1.3 Level of education

Table 4.1 depicts the level of education of the respondents. It was observed that; 45% respondents have bachelor's level of education, 30% respondents have secondary level of education, 20% have master's degree and 5% have PhD.

Table 4. 1: level of education of the respondents

Level of education	**Frequency**	**Percent**
Secondary level	30	30
Bachelor degree	45	45
Masters	20	20
PhD	5	5
Total	100	100

4.1.4. Occupation based on job position of the respondents

Table 4. 2**:** Respondents by Occupation or job position

Study population	Sample size	Percentage
Architects	20	20
Quantity surveyors	10	10
Project managers	10	10
Project managers	10	10

Foremen	10	10
Foremen	10	10
Project Engineers	10	10
Land surveyors	10	10
Engineer at sector level	1	1
Engineers at district level	3	3
Engineer at Rwanda Housing Authority	1	1
Total	**100**	100

Source: Primary data, September 2024

4.2. Presentation of the major findings

This section deals with the presentation, interpretation and discussion of the real results from respondents interviewed face-to-face including the data collected through questionnaire for respondents' view related to the causes of design errors in construction project, impacts of design errors in construction project and the impacts of design errors on initial cost of construction project.

4.2.1. Causes of design errors in construction project

The surveyed respondents were asked on the causes of design errors in construction project. The findings shown that the causes of design errors in construction project were the Speedy construction, Lack of detailed drawings, Engaging unqualified designers, Increase complexity in project, Poor supervision/coordination, Poor workmanship, Lack of systemic knowledge, Errors in calculations and the use of newly introduced materials, Unclear overview of the designs, Lack of coordination process, and Human mistakes, Insufficient fund to create quality documents, Insufficient time to create review quality documents, Low budgets for design, Project managers not understanding the scope of the project, Miss-coordination between lead designer and consultants, Confusion created by owner decisions or indecision's, and in turn, client not coordinating as to what is required, Designer rushes out drawings before proper review, Budget and time pressure on the designer, Lack of construction knowledge and experience of designers, Inadequate training, Engaging unqualified designers, Lack of knowledge about material performance, Unrealistic scheduling of design task functions and the use of time boxing, Underestimating the resources required for designing tasks, Poor bid or no bid responses. The following frequencies and percentages were found according to the results from the field among the respondents of the study.

Table 4. 3**: Causes of design errors in construction project**

Statements	**Agreed**		**Undecided**		**Disagreed**	
	Freq.	%	Freq.	%	Freq.	%
Speedy construction,	100	100	0	0	0	0
Lack of detailed drawings,	100	100	0	0	0	0
Engaging unqualified designers,	100	100	0	0	0	0
Increase complexity in project,	100	100	0	0	0	0
Poor supervision/coordination,	100	100	0	0	0	0

Poor workmanship,	100	100	0	0	0	0
Lack of systemic knowledge,	100	100	0	0	0	0
Errors in calculations and the use of newly introduced materials.	100	100	0	0	0	0
Unclear overview of the designs,	100	100	0	0	0	0
Lack of coordination process, and	100	100	0	0	0	0
Human mistakes	100	100	0	0	0	0
Insufficient fund to create quality documents,	100	100	0	0	0	0
Insufficient time to create review quality documents,	100	100	0	0	0	0
Low budgets for design,	100	100	0	0	0	0
Project managers not understanding the scope of the project,	100	100	0	0	0	0
Miss-coordination between lead designer and consultants;	100	100	0	0	0	0
Confusion created by owner decisions or indecision's, and in turn, client not coordinating as to what is required,	100	100	0	0	0	0
Designer rushes out drawings before proper review,	100	100	0	0	0	0

Budget and time pressure on the designer	100	100	0	0	0	0
Lack of construction knowledge and experience of designers,	100	100	0	0	0	0
Inadequate training,	100	100	0	0	0	0
Engaging unqualified designers,	100	100	0	0	0	0
Lack of knowledge about material performance,	100	100	0	0	0	0
Unrealistic scheduling of design task functions and the use of time boxing,	100	100	0	0	0	0
Underestimating the resources required for designing tasks	100	100	0	0	0	0
Poor bid or no bid responses	100	100	0	0	0	0

Based on the data collection through questionnaire and interview from the respondents of the project, all respondents were agree 100% with the researcher that the causes of design errors in construction project are Speedy construction, Lack of detailed drawings, Engaging unqualified designers, Increase complexity in project, Poor supervision/coordination, Poor workmanship, Lack of systemic knowledge, Errors in calculations and the use of newly introduced materials, Unclear overview of the designs, Lack of coordination process, and Human mistakes, Insufficient fund to create quality documents, Insufficient time to create review quality documents, Low budgets for design, Project managers not understanding the scope of the project, Miss-coordination between lead designer and consultants, Confusion created by owner decisions or indecision's, and in turn, client not coordinating as to what is required, Designer rushes out drawings before proper review, Budget and time pressure on the designer, Lack of construction knowledge and experience of designers, Inadequate training, Engaging unqualified

designers, Lack of knowledge about material performance, Unrealistic scheduling of design task functions and the use of time boxing, Underestimating the resources required for designing tasks, Poor bid or no bid responses.

4.2.2. The impacts of design errors in construction Project.

The surveyed respondents were asked on the impacts of design errors in construction Project**.** The findings shown that the impacts of design errors in construction Project were construction project cost overruns, Schedule delays, Unsafe environments which affect project performance, Failures occurring in civil engineering projects, Cause pressure on the schedule and also affect the quality of the work, Design error makes the amount spent on rework at design face to be more than the one at construction stage and design errors influence the quality of design**.** The following frequencies and percentages were found according to the results from the field among the respondents of the study.

Table 4. 4**:** Impacts of design errors in construction Project

Statements	**Agreed**		**Undecided**		**Disagreed**	
	Freq.	%	Freq.	%	Freq.	%
Construction project cost overruns,	100	100	0	0	0	0
Schedule delays	100	100	0	0	0	0
Unsafe environments which affect project performance	100	100	0	0	0	0
Failures occurring in civil engineering projects.	100	100	0	0	0	0
Cause pressure on the schedule and also affect the quality of the work,	100	100	0	0	0	0
Design error makes the amount spent on rework at design face to be more than the one at construction stage	100	100	0	0	0	0

Design errors influence the quality of design	100	100	0	0	0	0

Based on the data collection through questionnaire and interview from the respondents of the project, all respondents were agree 100% with the researcher that the impacts of design errors in construction Project were construction project cost overruns, Schedule delays, Unsafe environments which affect project performance, Failures occurring in civil engineering projects, Cause pressure on the schedule and also affect the quality of the work, Design error makes the amount spent on rework at design face to be more than the one at construction stage and design errors influence the quality of design**.** The following frequencies and percentages were found according to the results from the field among the respondents of the study.

4.2.3. Impacts of design errors on initial cost of construction Project

The surveyed respondents were asked on the impacts of design errors on initial cost of construction Project**.** The findings shown that the impacts of design errors on initial cost of construction Project were Design errors contributes to accident on site, the cost of rectifying errors and omission increases a project cost, design errors contributes to project failures accidents and loss of life, design error result in time and cost overrun and design errors can adversely influence project performance. The following frequencies and percentages were found according to the results from the field among the respondents of the study.

Table 4. 5**: Impacts of design errors on initial cost of construction Project**

Statements	**Agreed**		**Undecided**		**Disagreed**	
	Freq.	%	Freq.	%	Freq.	%
Design errors contributes to accident on site	100	100	0	0	0	0
The cost of rectifying errors and omission increases a project cost	100	100	0	0	0	0
Design errors contributes to project	100	100	0	0	0	0

failures accidents and loss of life						
Design error result in time and cost over run	100	100	0	0	0	0
Design errors can adversely influence project performance	100	100	0	0	0	0

Based on the data collection through questionnaire and interview from the respondents of the project, all respondents were agree 100% with the researcher that the impacts of design errors on initial cost of construction project are design errors contributes to accident on site, the cost of rectifying errors and omission increases a project cost, design errors contributes to project failures accidents and loss of life, design error result in time and cost overrun and design errors can adversely influence project performance.

CHAPTER FIVE : CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The main objective of this study was to investigate how design errors can affect the initial cost of construction project. The specific objectives were to identify the causes of design errors in construction Project, to examine the impacts of design errors in construction Project and to examine the impacts of design errors on initial cost of construction Project. The questionnaire survey conducted in the 100 respondents from the active construction companies in Kanombe sector. Collected data were analyzed by tables and ranked using SPSS software. Based on the findings, it is concluded that the causes of design errors in construction project were the Speedy construction, Lack of detailed drawings, Engaging unqualified designers, Increase complexity in project, Poor supervision/coordination, Poor workmanship, Lack of systemic knowledge, Errors in calculations and the use of newly introduced materials, Unclear overview of the designs, Lack of coordination process, and Human mistakes, Insufficient fund to create quality documents, Insufficient time to create review quality documents, Low budgets for design, Project managers not understanding the scope of the project, Miss-coordination between lead designer and consultants, Confusion created by owner decisions or indecision's, and in turn, client not coordinating as to what is required, Designer rushes out drawings before proper review, Budget and time pressure on the designer, Lack of construction knowledge and experience of designers, Inadequate training, Engaging unqualified designers, Lack of knowledge about material performance, Unrealistic scheduling of design task functions and the use of time boxing, Underestimating the resources required for designing tasks, Poor bid or no bid responses. Based on the impacts of design errors in construction Project, the findings show that the impacts of design errors in construction Project were construction project cost overruns, Schedule delays, Unsafe environments which affect project performance, Failures occurring in civil engineering projects, Cause pressure on the schedule and also affect the quality of the work, Design error makes the amount spent on rework at design face to be more than the one at construction stage and design errors influence the quality of design. The findings shown that the impacts of design errors on initial cost of construction Project were Design errors contributes to accident on site, the cost of rectifying errors and omission increases a project cost, design errors contributes to

project failures accidents and loss of life, design error result in time and cost overrun and design errors can adversely influence project performance

5.2. Recommendation

The findings of this study imply that it gives the needed knowledge of the likely cost and time of error in construction documents on building projects to quantity surveyors/estimators, construction managers, consultants, clients, educators and policymakers so that the likely final contract sum and duration of construction projects could be predicted based on the errors in construction documents. Therefore, while the methods of mitigating errors in construction documents are still being investigated, the study recommends that quantity surveyors/estimators should add about 10% to the calculated contract sum of construction projects and construction managers/contractors should about 20% to the scheduled duration of building projects.

Furthermore, a quality control mechanism in the form of buildability analysis should be put in place to ensure that construction documents especially drawing go through a series of checks to reduce design errors, omissions, under/over measurement and use of wrong units/quantities. Clients and policymakers should make laws that would foster the adoption of management procurement methods for construction projects. Very importantly, professional builders must be engaged at the inception/design stage of a building project to capture the design errors in construction documents. This study is limited in geographical coverage as it covers only the South western states of Nigeria. Hence, it may not be readily generalised for all building projects. However, it is a pointer to where research efforts are required in the construction industry to achieve optimal project performance.

Therefore, similar studies may be conducted in other geographical areas to validate the findings of this study. In addition, this study can be furthered by conducting similar studies on other types of construction projects such as civil engineering, oil and gas and telecommunication projects, to determine if the figures obtained in this study are generally applicable. Hence, this study is useful for practice as designers and clients will be convinced of the need to specifically make allowance for cost and time of errors in the design of construction projects. For academia, this

study will be a basis for advanced studies aimed at calculating and mitigating the effects of the cost of errors in construction projects. Also, the study will complement existing studies on errors in construction documents in the developed and developing countries.

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APPENDIX

Appendix A: Structure of questionnaires for respondents

Field questionnaire for respondents

I, **UWAJENEZA Noella,** as finalist student at ULK Polytechnic Institute, department of Civil engineering and construction option. I am conducting a research entitled **"INVESIGATION INTO THE DESIGN ERRORS AND ITS IMPACT ON INITIAL COST OF CONSTRUCTION PROJECT.CASE STUDY: KANOMBE SECTOR IN KICUKIRO DISTRICT''.** Thus, this questionnaire will help to collect basis data for the research. This survey questionnaire has purely academic goals, and any information provided is confidential and will be utilized exclusively for the study. It would be greatly appreciated for offering me few minutes from your time for responding the following questions.

Section A: Biographical information of participants

Answering each question please put a tick on the right answer.

1) Kindly indicate your gender.

- ○ Female
- ○ Male

3) Kindly indicate your age group.

- ○ 18-30 Years
- ○ 31 -40 Years
- ○ 41-50 Years
- ○ 51-60 Years
- ○ Above 60 Years

4) Indicate your Level of Education

- ○ Secondary school
- ○ University level
- ○ Masters

5) Indicate your job position

Architects	
Quantity surveyors	
Project managers	
Project managers	
Foremen	
Foremen	
Project Engineers	
Land surveyors	
Engineer at sector level	
Engineers at district level	

Engineer at Rwanda Housing Authority	

Section B: Open questions

Please tick the most appropriate

1. What are the causes of design errors in construction project?

Speedy construction,	
Lack of detailed drawings,	
Engaging unqualified designers,	
Increase complexity in project,	
Poor supervision/coordination,	
Poor workmanship,	
Lack of systemic knowledge,	
Errors in calculations and the use of newly introduced materials.	
Unclear overview of the designs,	
Lack of coordination process, and	
Human mistakes	
Insufficient fund to create quality documents,	
Insufficient time to create review quality documents,	
Low budgets for design,	
Project managers not understanding the scope of the project,	
Miss-coordination between lead designer and consultants;	

Confusion created by owner decisions or indecision's, and in turn, client not coordinating as to what is required,	
Designer rushes out drawings before proper review,	
Budget and time pressure on the designer	
Lack of construction knowledge and experience of designers,	
Inadequate training,	
Engaging unqualified designers,	
Lack of knowledge about material performance,	
Unrealistic scheduling of design task functions and the use of time boxing,	
Underestimating the resources required for designing tasks	
Poor bid or no bid responses	

2. What are impacts of design errors in construction Project?

Construction project cost overruns,	
Schedule delays	
Unsafe environments which affect project performance	
Failures occurring in civil engineering projects.	
Cause pressure on the schedule and also affect the quality of the work,	
Design error makes the amount spent on rework at design face to be more than the one at construction stage	

Design errors influence the quality of design	

3. What are the impacts of design errors on initial cost of construction Project?

Design errors contributes to accident on site	
The cost of rectifying errors and omission increases a project cost	
Design errors contributes to project failures accidents and loss of life	
Design error result in time and cost over run	
Design errors can adversely influence project performance	

Thankyou!